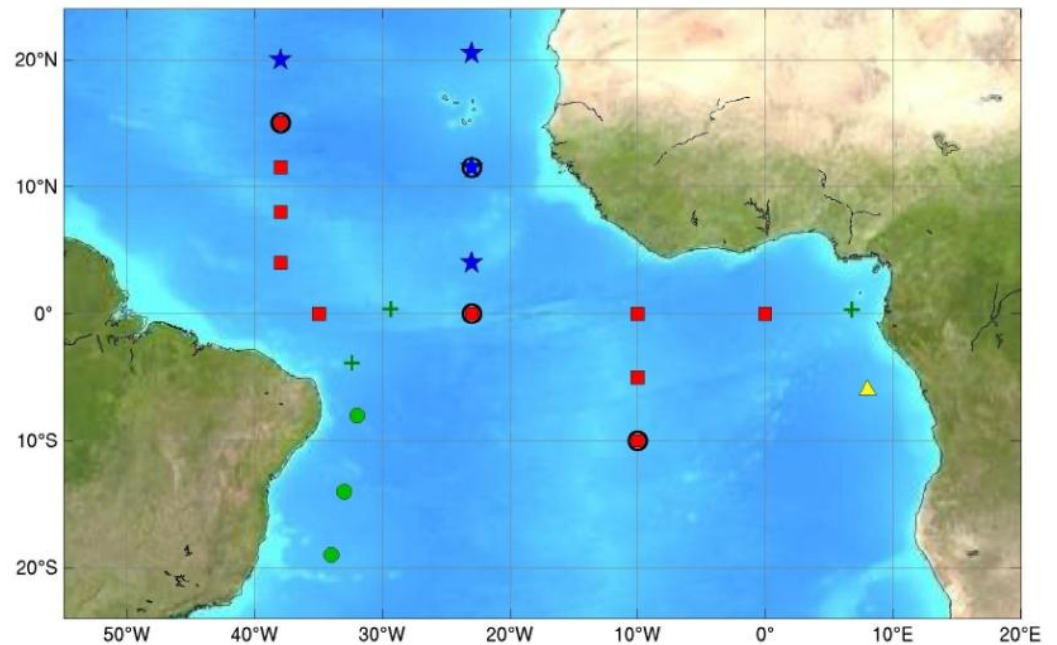
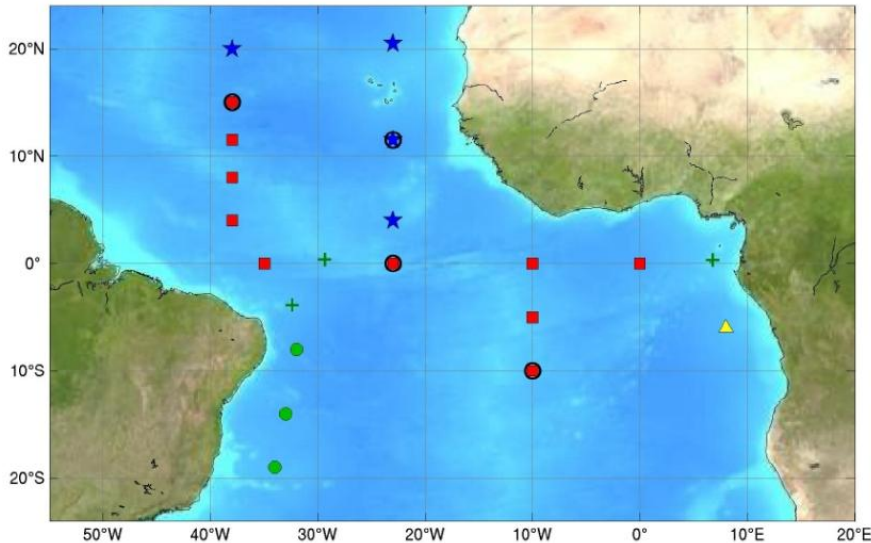


Salinity (and other) observations by the PIRATA project

Rick Lumpkin
NOAA/OAR/AOML



The PIRATA project



The Prediction and Research Moored Array in the Tropical Atlantic (PIRATA) is a multinational observation network, established to improve our knowledge and understanding of ocean-atmosphere variability in the tropical Atlantic. It is a joint project of Brazil, France and the United States of America.

PIRATA goals:

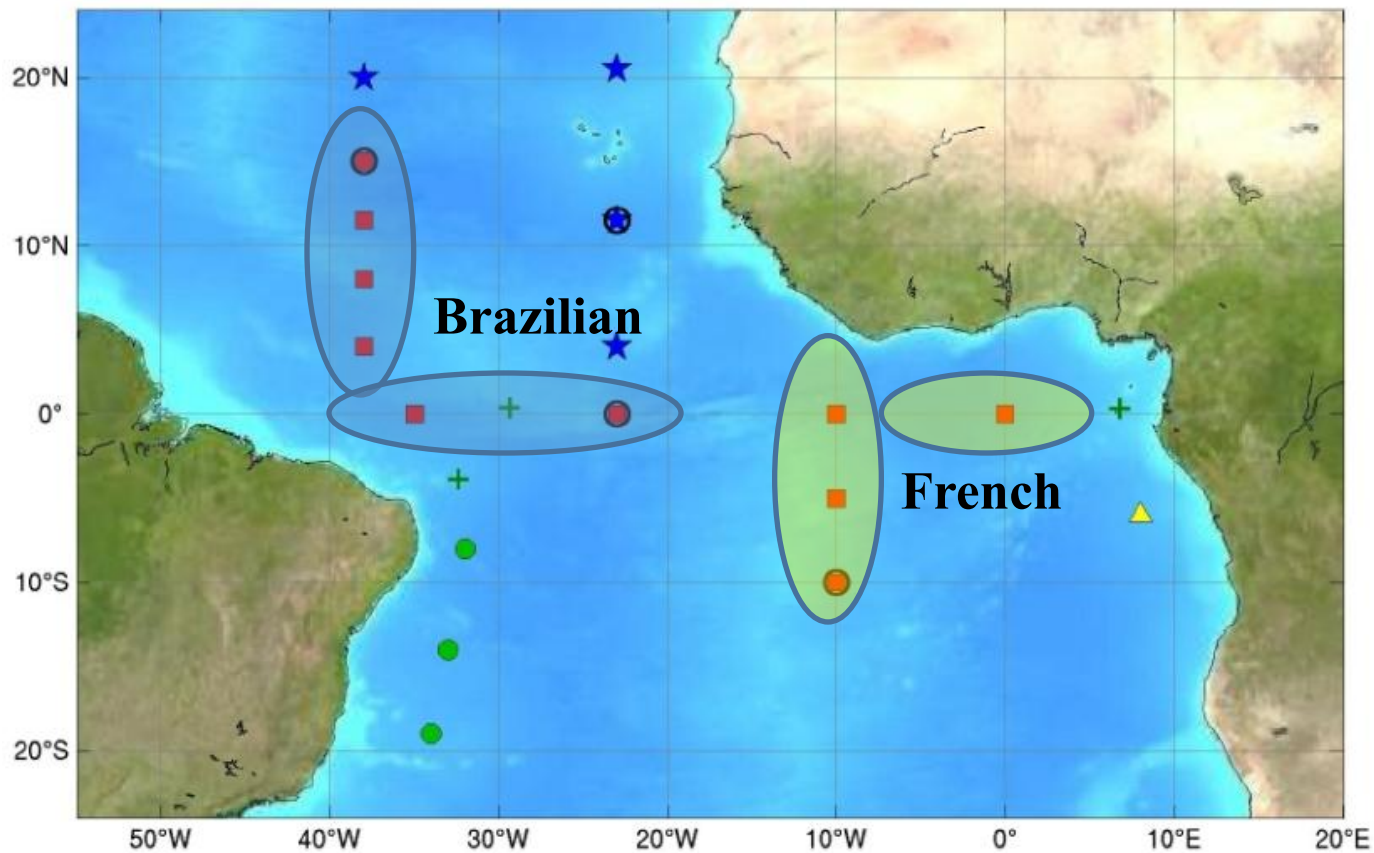
- **improve description of intra-seasonal to interannual variability in the atmospheric and oceanic boundary layers of the tropical Atlantic Ocean;**
- **improve understanding of relative contributions of air-sea fluxes and ocean dynamics to variability in sea surface temperature and sub-surface heat content;**
- **provide a data for developing and improving predictive models ;**
- **document teleconnections with other regions;**
- **design, deploy, and maintain an array of moored oceanic buoys and collect and transmit a set of oceanic and atmospheric data, via satellite in near-real time, to monitor and study the upper ocean and atmosphere of the tropical Atlantic Ocean.**

PIRATA backbone

Red squares: 10 backbone moorings.

First deployed 1997.

Design motivated by two modes of interannual variability.

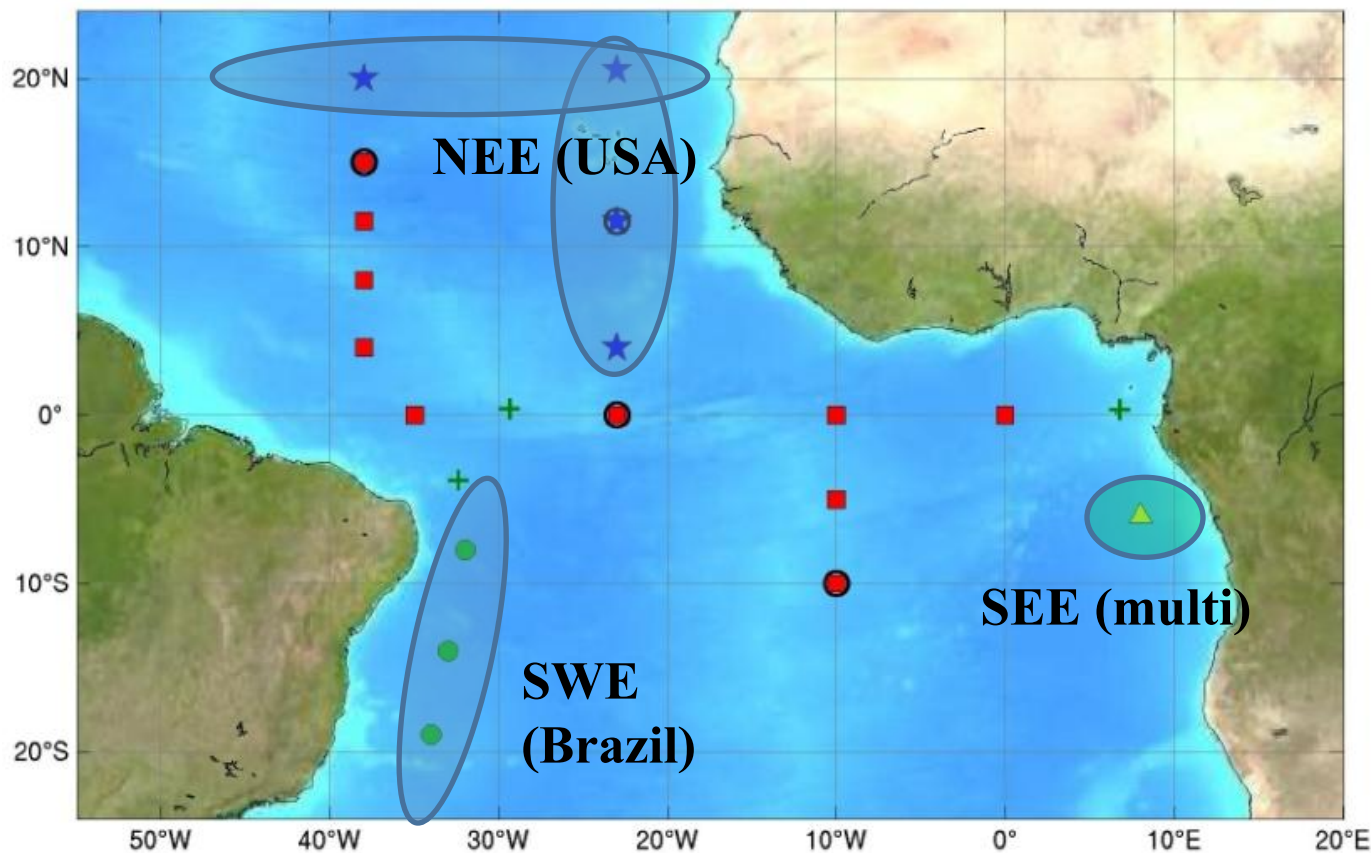


PIRATA extensions

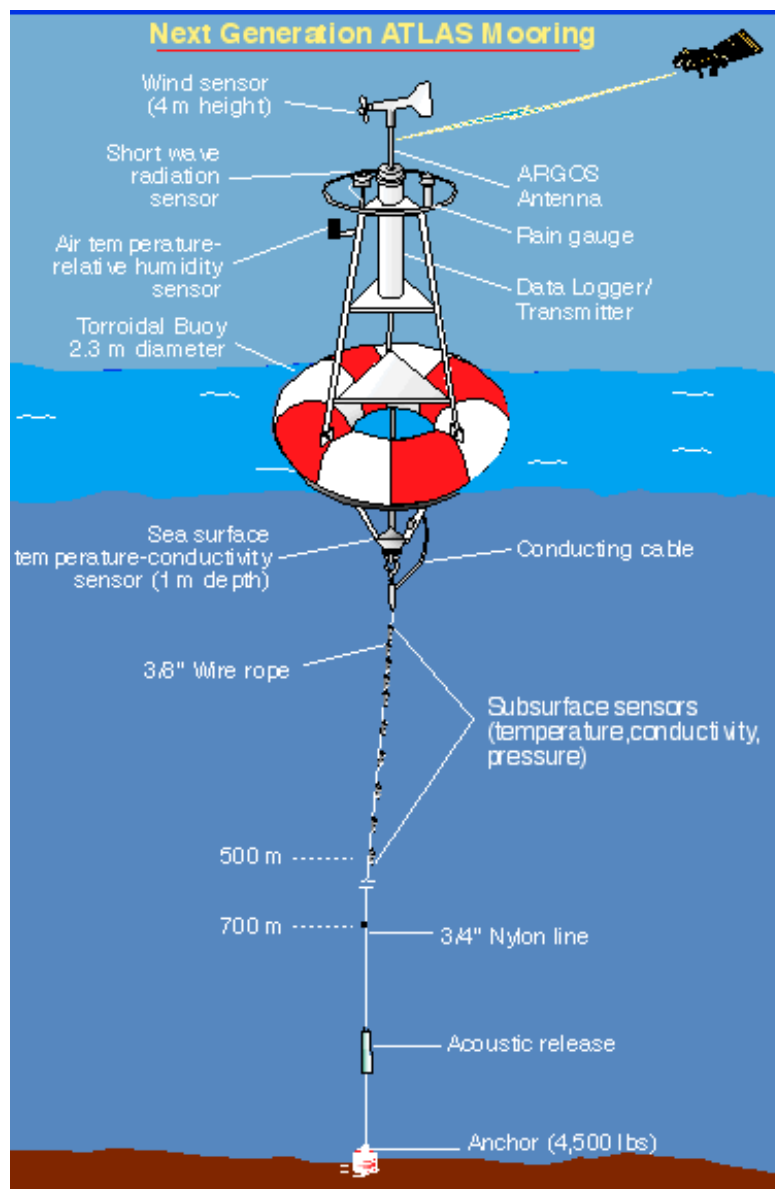
Three extensions, starting in late 2005.

PIRATA Northeast Extension (PNE): joint AOML/PMEL project.

PNE Goal: study climate variability in Main Development Region; observe ITCZ, TIWs, Guinea Dome, Oxygen Minimum Zone.



Autonomous Temperature Line Acquisition System (ATLAS) mooring



More information at: http://www.pmel.noaa.gov/tao/proj_over/proj_over.html

ATLAS moored buoys measure:

surface meteorological variables

wind direction and speed

air temperature

humidity

rainfall

solar radiation

longwave radiation (some)

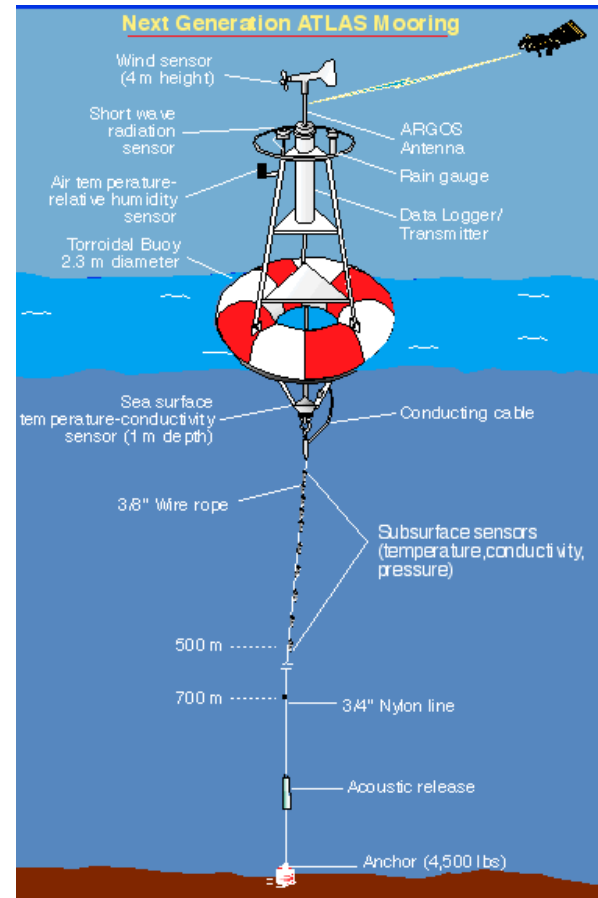
barometric pressure (some)

oceanic properties between the surface and 500 m

temperature

salinity

ocean currents (some)

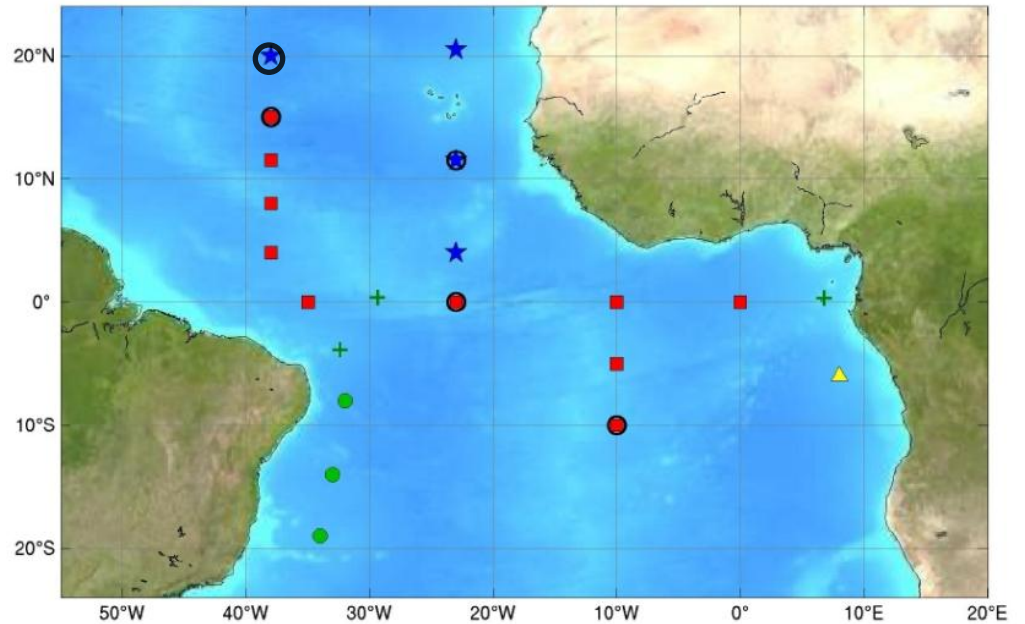


20°N, 38°W enhancement for SPURS

Added longwave, barometer to bring to full flux configuration.

Added temperature/conductivity at 5 m and at 30 m to previous depths (T/C at 1 m, 10 m, 20 m, 40 m, 60 m, 120 m).

Enhancements added on summer 2011 PNE cruise; planned to be replaced on 2012 PNE cruise.



Tropical Flex (ATLAS Update)

Mooring System

PMEL TFlex Sensor Suite	
Measurement	Sensor Model Number
Wind Speed and Direction	Gill Windsonic (with compass integrated by PMEL)
Compass	Sparton SP3004D
Air Temperature and Relative Humidity	Rotronic HC2-S3
Precipitation	R. M. Young Capacitance Rain Gauge 50203-34 *
Shortwave Radiation	Eppler Laboratory: PSP-TAO, Delrin case *
Longwave Radiation	Eppler Laboratory: PIR-TAO, Delrin case, 3-output *
Barometric Pressure	Druck RPT350
Water Temperature	SBE39T-IM, SBE39TP-IM, or SBE37TC-IM
Water Conductivity	SBE37TC-IM
Water Pressure	SBE39TP-IM
Current Velocity	Nortek Aquadopp

* Sensor also used on ATLAS

Sampling, Averaging and Telemetry

Measurement	Sample Rate	Average	Recorded Resolution	Telemetered Resolution	Call Frequency
Wind Speed, Direction, Air Temperature, Relative Humidity	1 sec	2 min	10 min	hourly	6 hours
Rain and Radiation	1 sec	1 min	1 min		
Barometric Pressure	1 sec	2 min	hourly		
Water Temperature, Conductivity, Pressure	1 sample	1 sample	10 min		
Current	1 sec	2 min	10 min		



Annual PNE Cruises

Annual cruises by NOAA ship Ronald H. Brown to service the four PNE moorings at (20°N , 38°W) and along 23°W at 20.5°N , 11.5°N , and 4°N . Conducted since 2006.

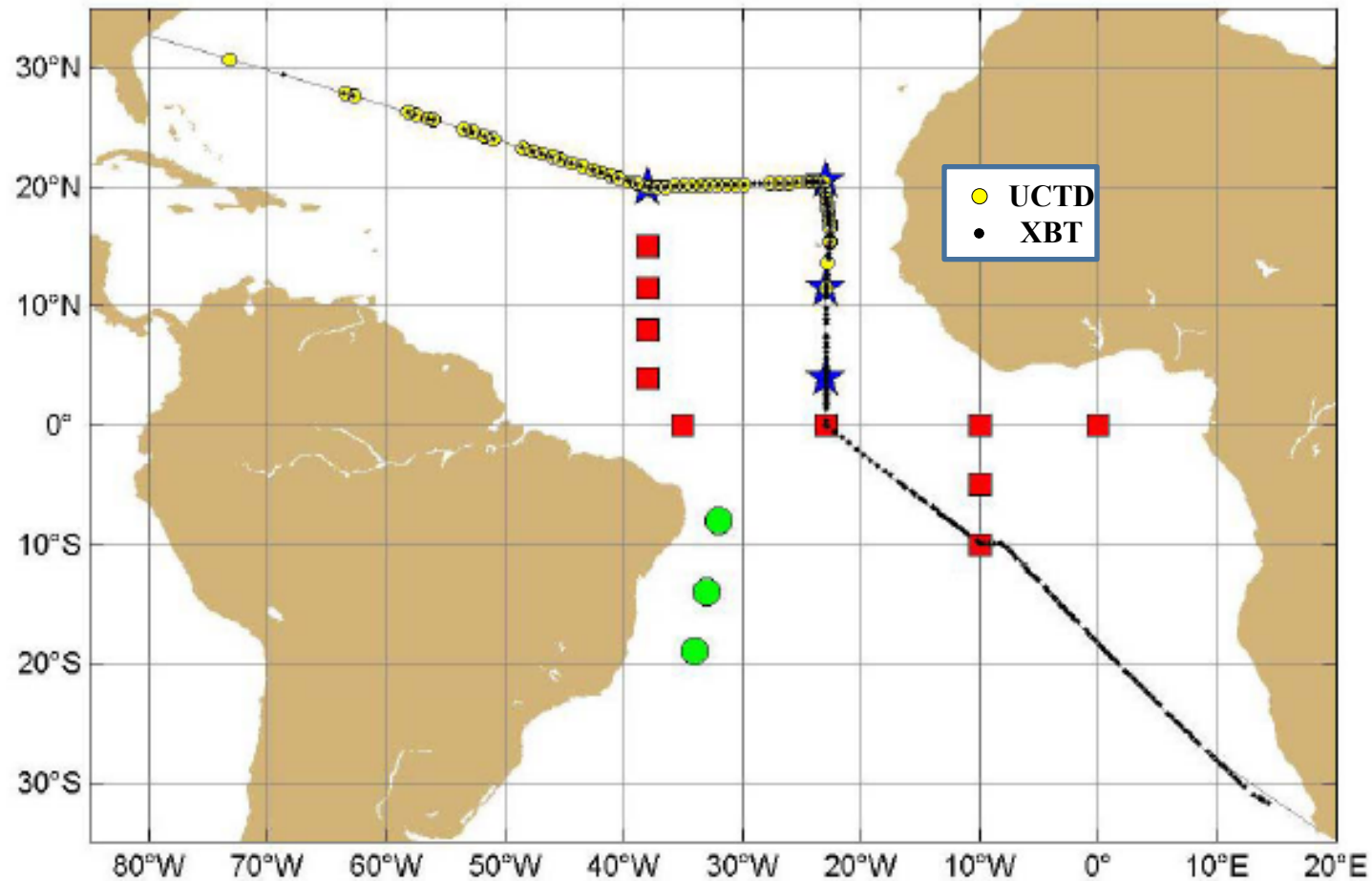
CTD casts conducted at all PNE moorings and typically along 23°W from 20.5°N to 4°N (often to equator). In some years (e.g., 2011): “PNE lite”. Not enough ship time for 23°W CTD section.

Surface drifters, Argo floats, radio sondes, ozone sondes, XBTs deployed.



PNE2011 (21 July—21 August)

Chief scientist: Rick Lumpkin, AOML



Cruise track of the R/V *Ronald H. Brown* during PNE2011, Charleston to Cape Town

ATLAS/T-FLEX mooring operations

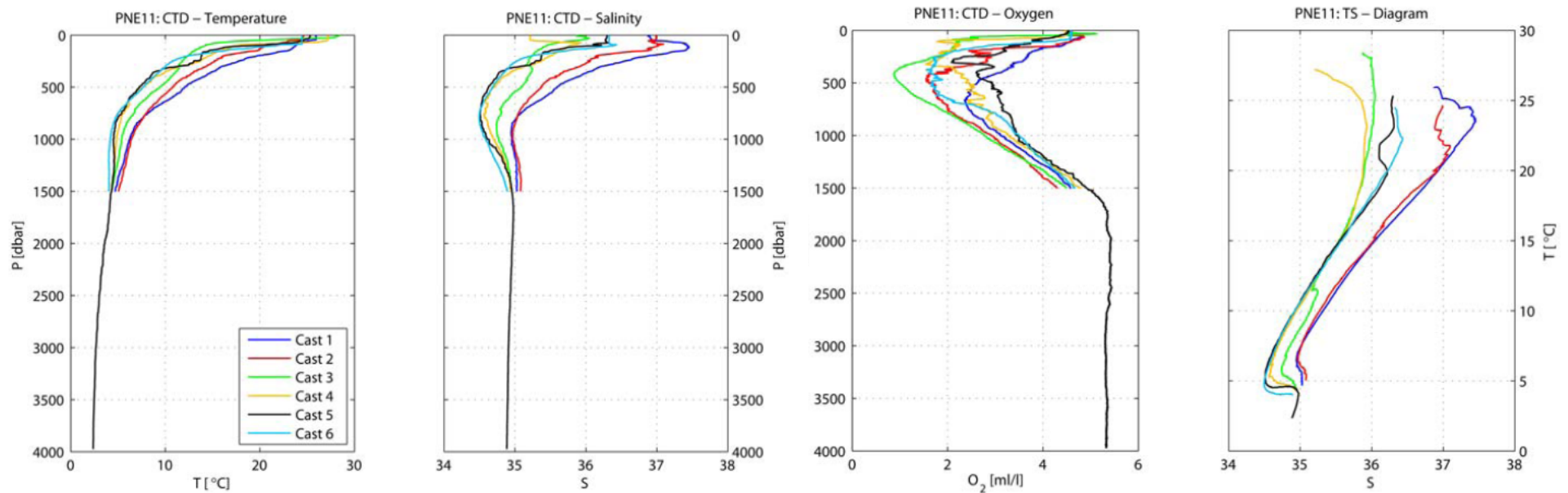


ATLAS recovery/deployment at 20°N 38°W; 20.5/11.5/4°N 23W.

T-FLEX mooring deployed at 20°N 38°W, <5 miles from ATLAS mooring (additional observations also in support of SPURS)

Repairs: Eq-23°W (wind, tube swap); 10°S 10°W (rain gauge, ADCP).

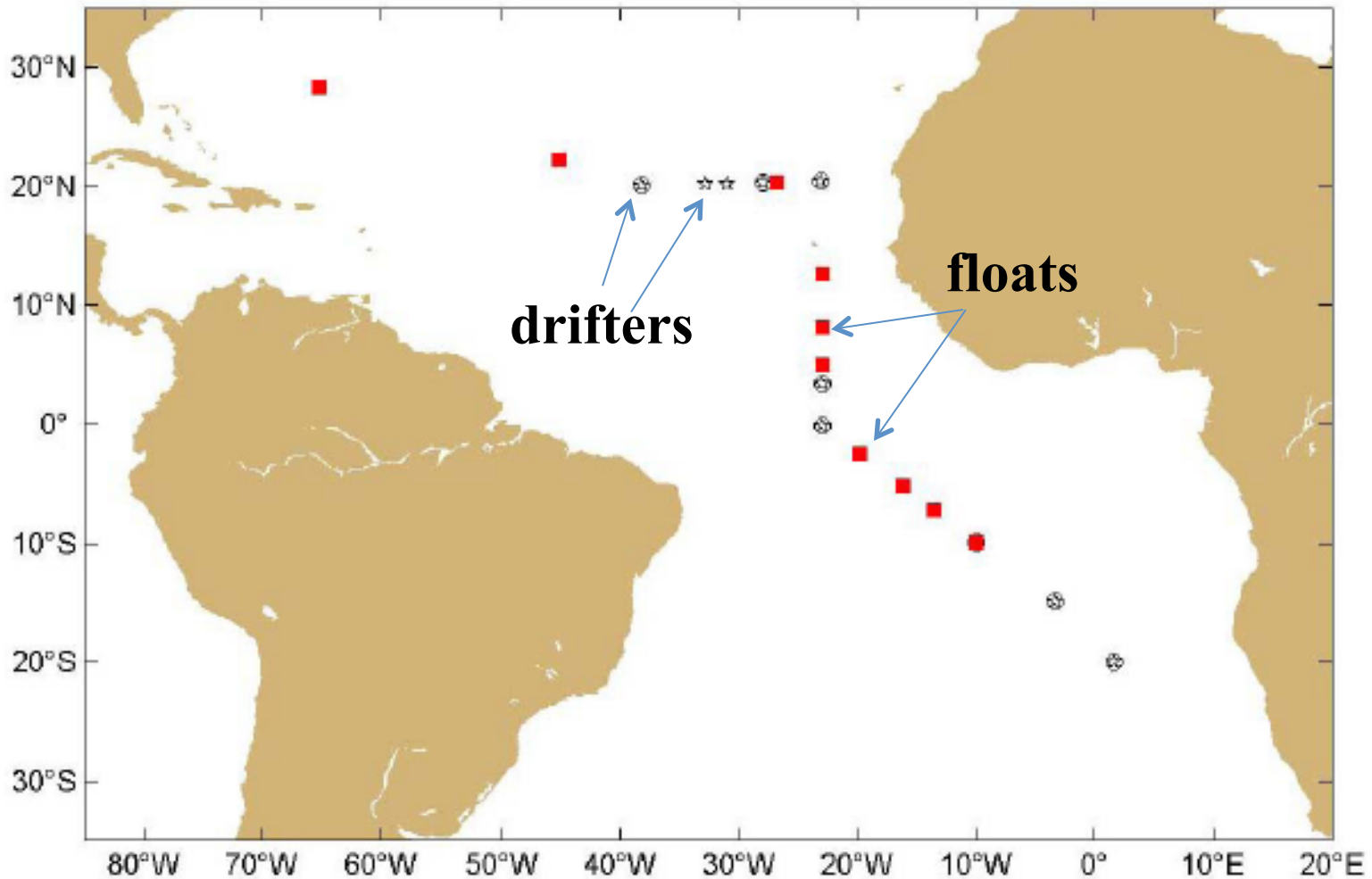
CTD casts at four PNE sites + Eq-23°W and 10°S 10°W



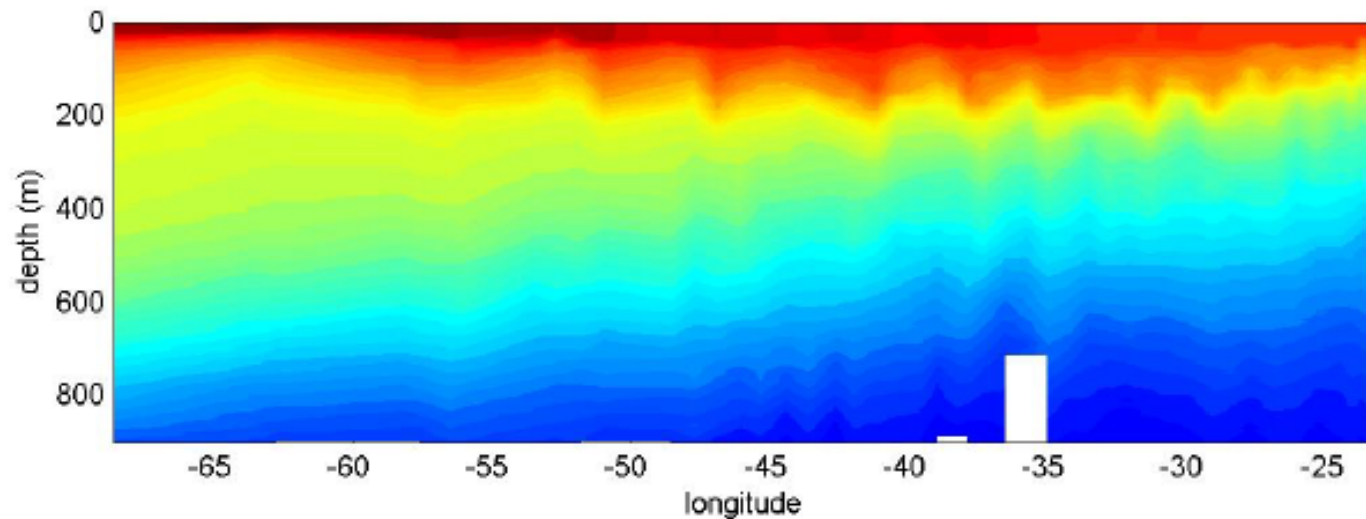
Cast #	Date	Start Time	Bottom Time	End Time	Lat	Lon
1	30-Jul	2:24	2:56	3:41	20°01.446'N	037°50.959'W
2	3-Aug	12:38	13:19	14:04	20°26.683'N	023°07.843'W
3	5-Aug	16:47	17:23	18:07	11°28.536'N	023°00.671'W
4	7-Aug	19:50	20:32	21:16	04°01.057'N	022°59.167'W
5	9-Aug	11:10	12:22	14:01	00°01.505'N	023°01.022'W
6	13-Aug	13:51	14:22	15:00	09°54.150'S	009°59.545'W

CTD data transmitted in near-real time on GTS.

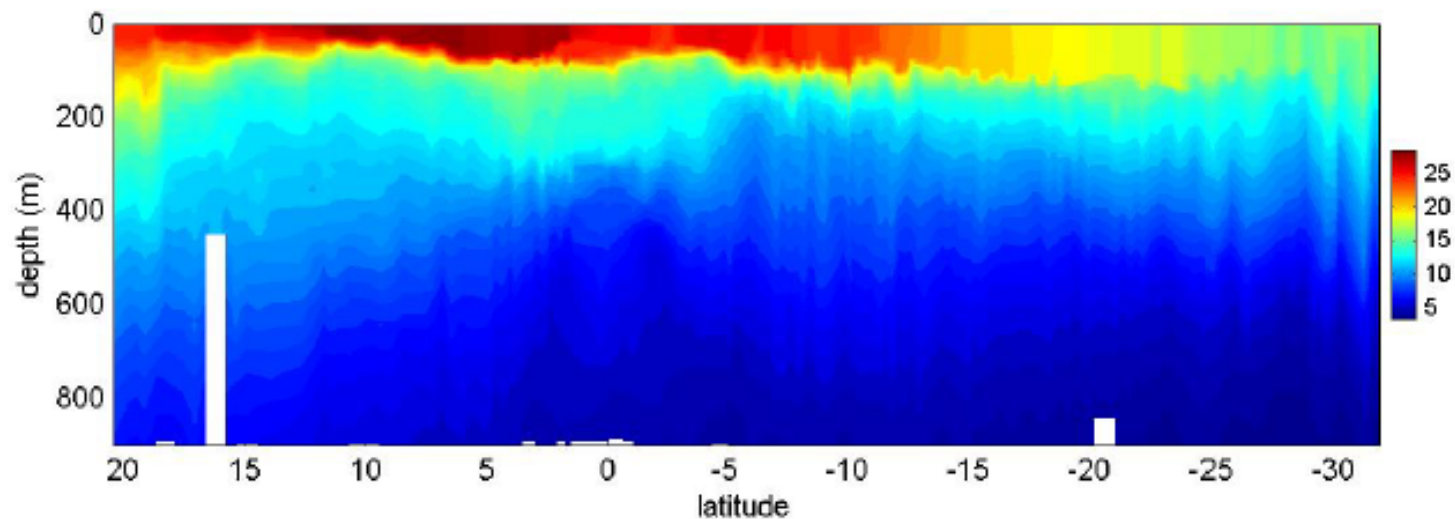
20 Global Drifter Program drifters, 10 Argo float deployments



XBT: 207 casts



Top:
temperature
section from
Charleston, SC to
20.5N 23W from
XBTs.

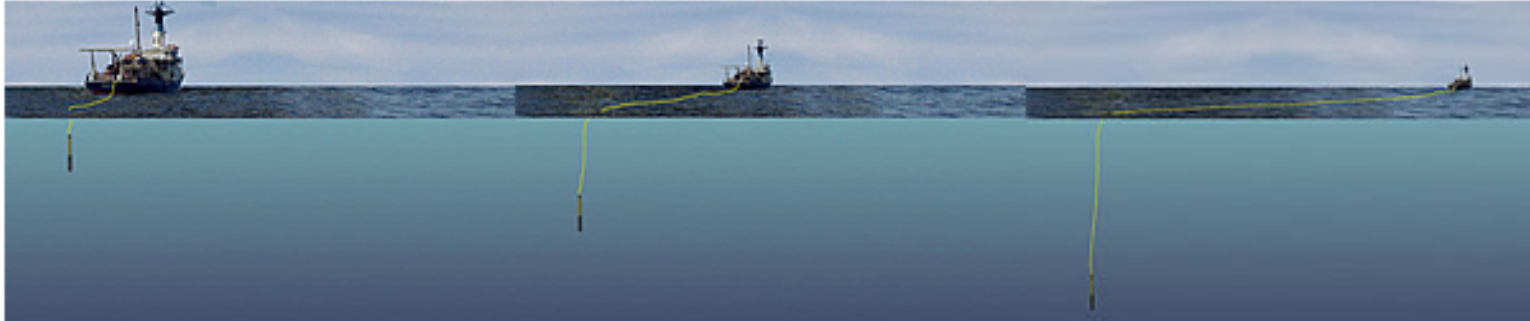


Bottom:
temperature
section from
20.5N 23W to
Cape Town, SA
from XBTs.

**All casts put on
GTS in near-real
time.**

Underway CTD system

(Just starboard of A-frame)



Probe contains Sea-Bird CTD sensor.

**Measures Temperature,
Conductivity, Pressure.**



**Bluetooth wireless communications
with computer in wet lab.**

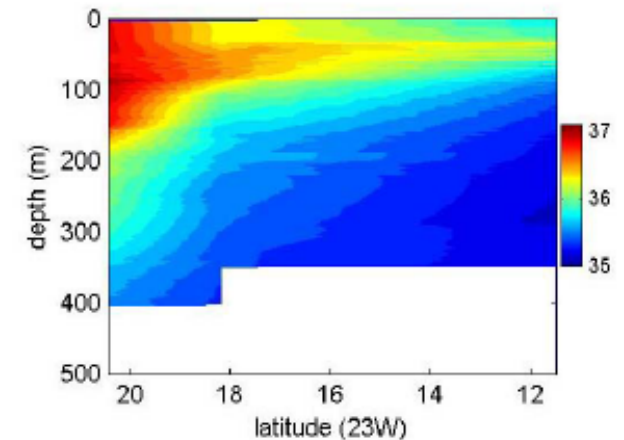
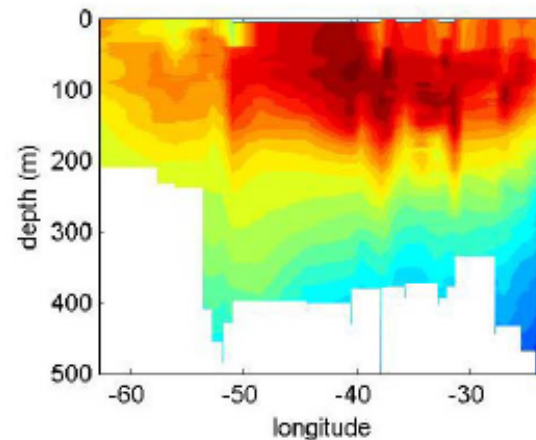
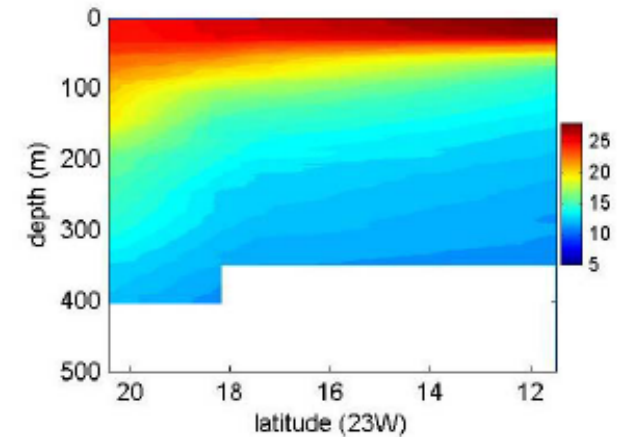
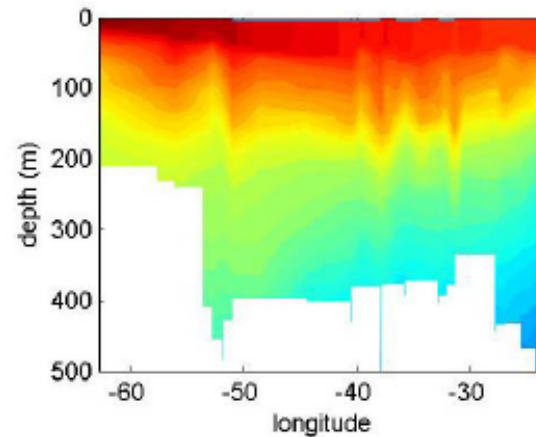
Images from Oceanscience.com

Underway CTD system

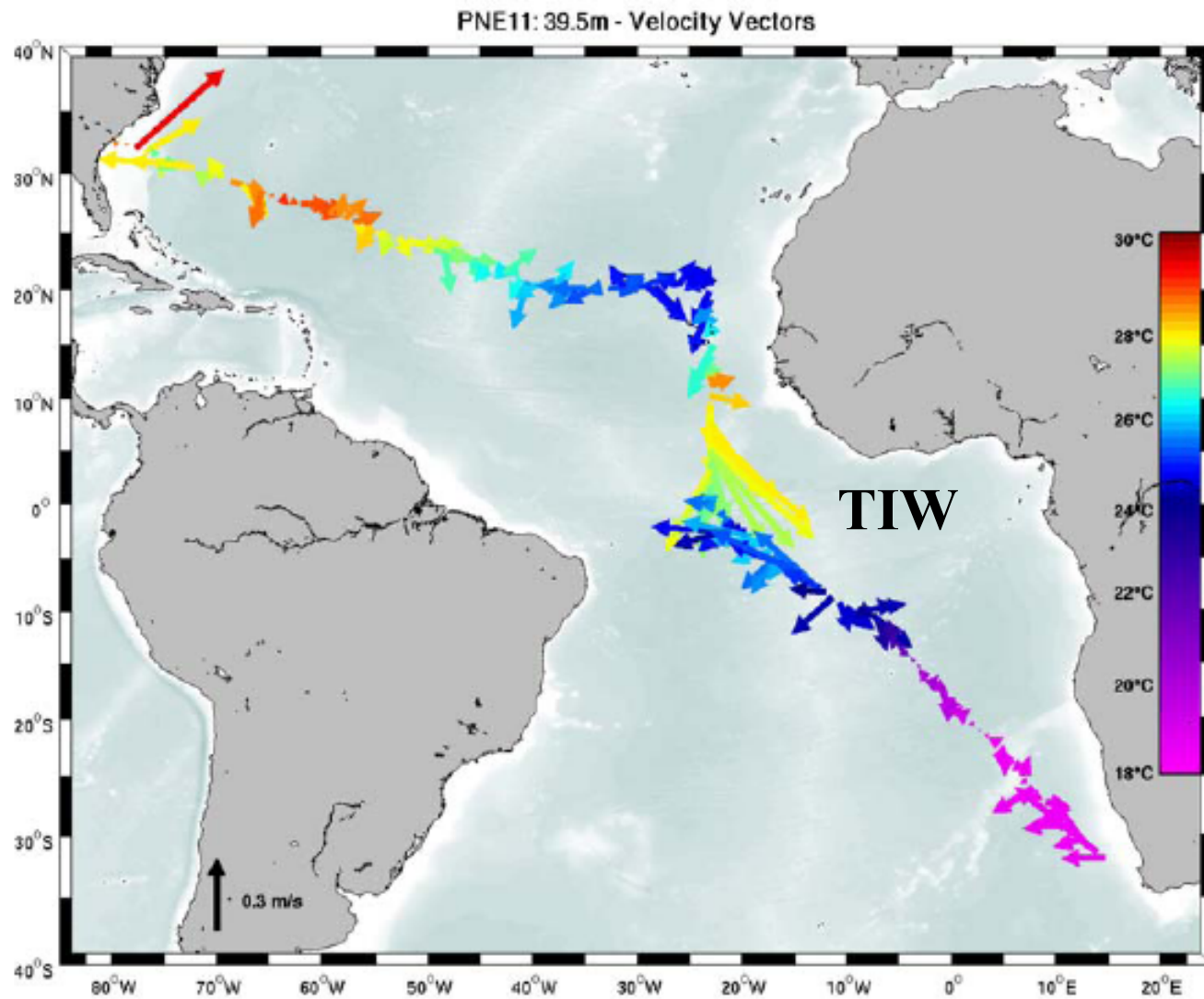


~60 casts to maximum depth 500m.

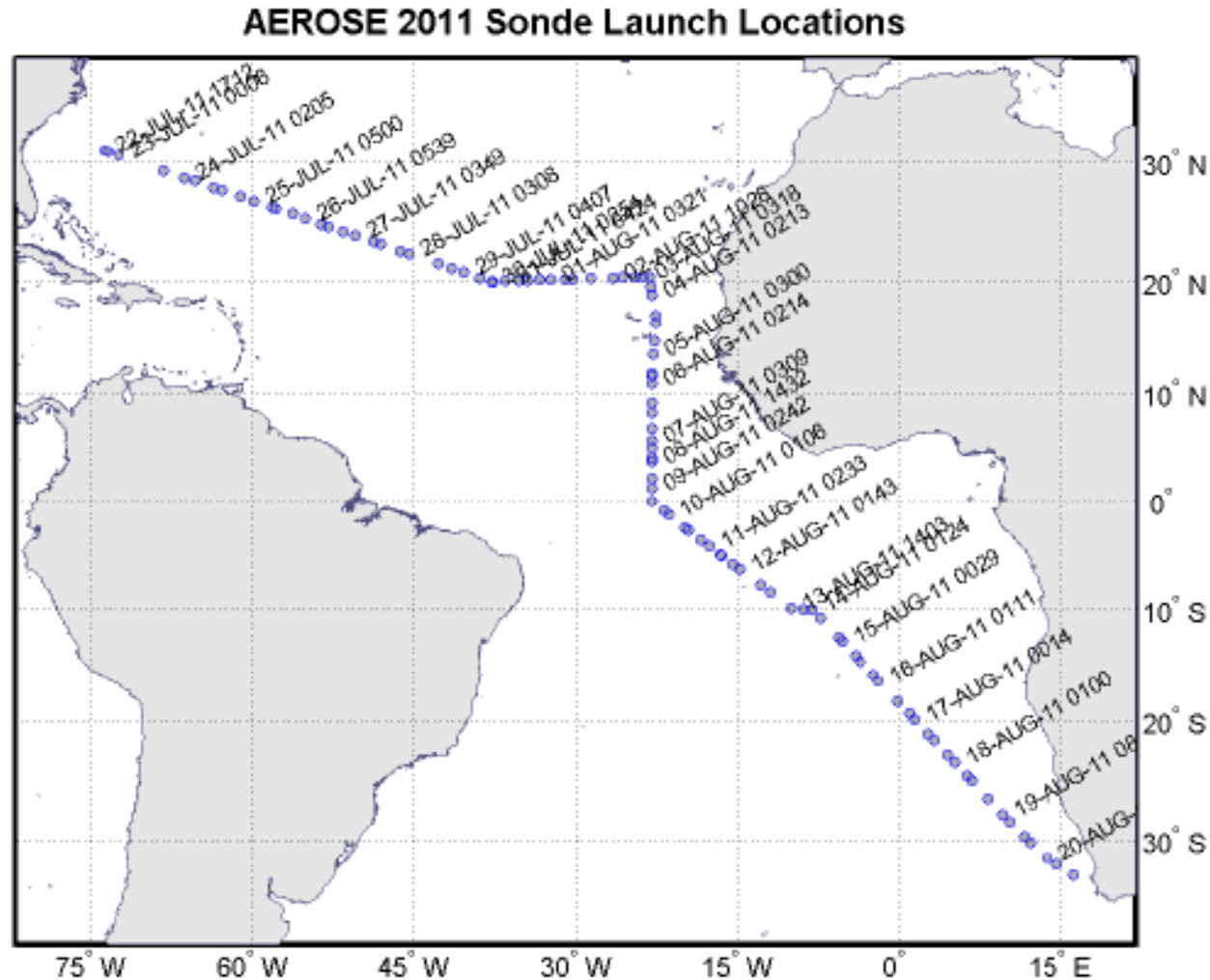
Recommendations for Improvements/changes given in report to OceanScience, who implemented a number of improvements. Upgraded and more robust system currently being tested on PNE2013.



Shipboard ADCP



AEROSE: Howard Univ/NESDIS



Data available at [ftp/web servers](ftp://ftp.nesdis.noaa.gov) at NESDIS and NOAA/ESRL/PSD

Ancillary data

including AEROSE observations

- IFM-GEOMAR oxygen sensors at 300m, 500m on 4°N 23°W, 11.5°N 23°W sites.
 - Hydrophone moorings deployed at 4 sites along cruise track.
 - Shipboard TSG, meteorological observations
 - 107 Vaisala RS92 rawinsondes launched, 26 with ozonesondes
 - Continuous measurements of ozone, carbon monoxide and sulfur dioxide
 - Surface-level aerosol mass and number distribution characteristics
 - Continuous radiometric broadband flux measurements (SW, LW)
-

PNE 2012 cruise

Planned start 31 August 2012 from Bermuda.

Starboard propulsion motor failed, deemed “not reliable for operations” on 30 August.

R/V Ronald H. Brown returned to Charleston, SC for repairs.

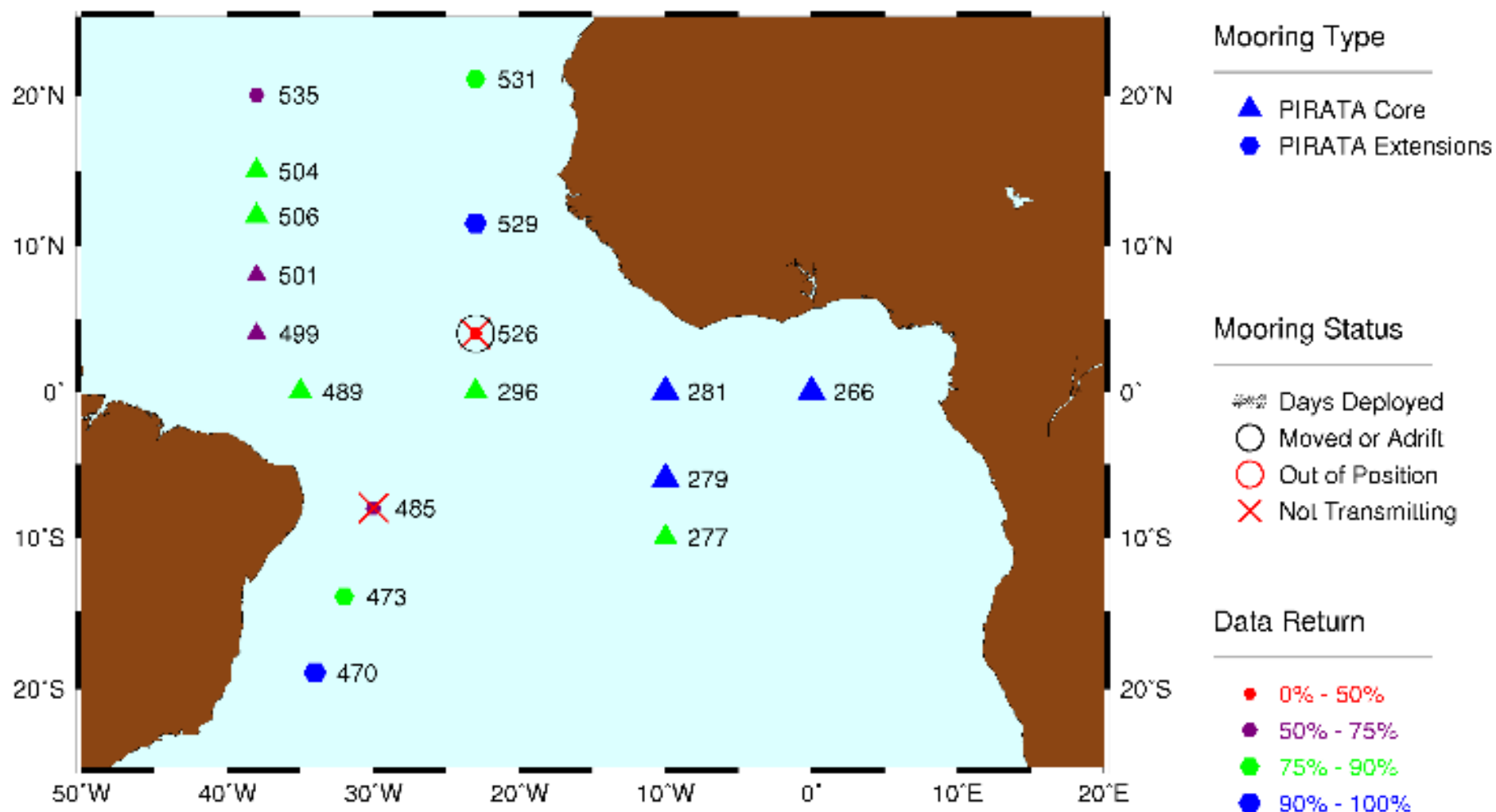
PNE cruise delayed until January 2013.

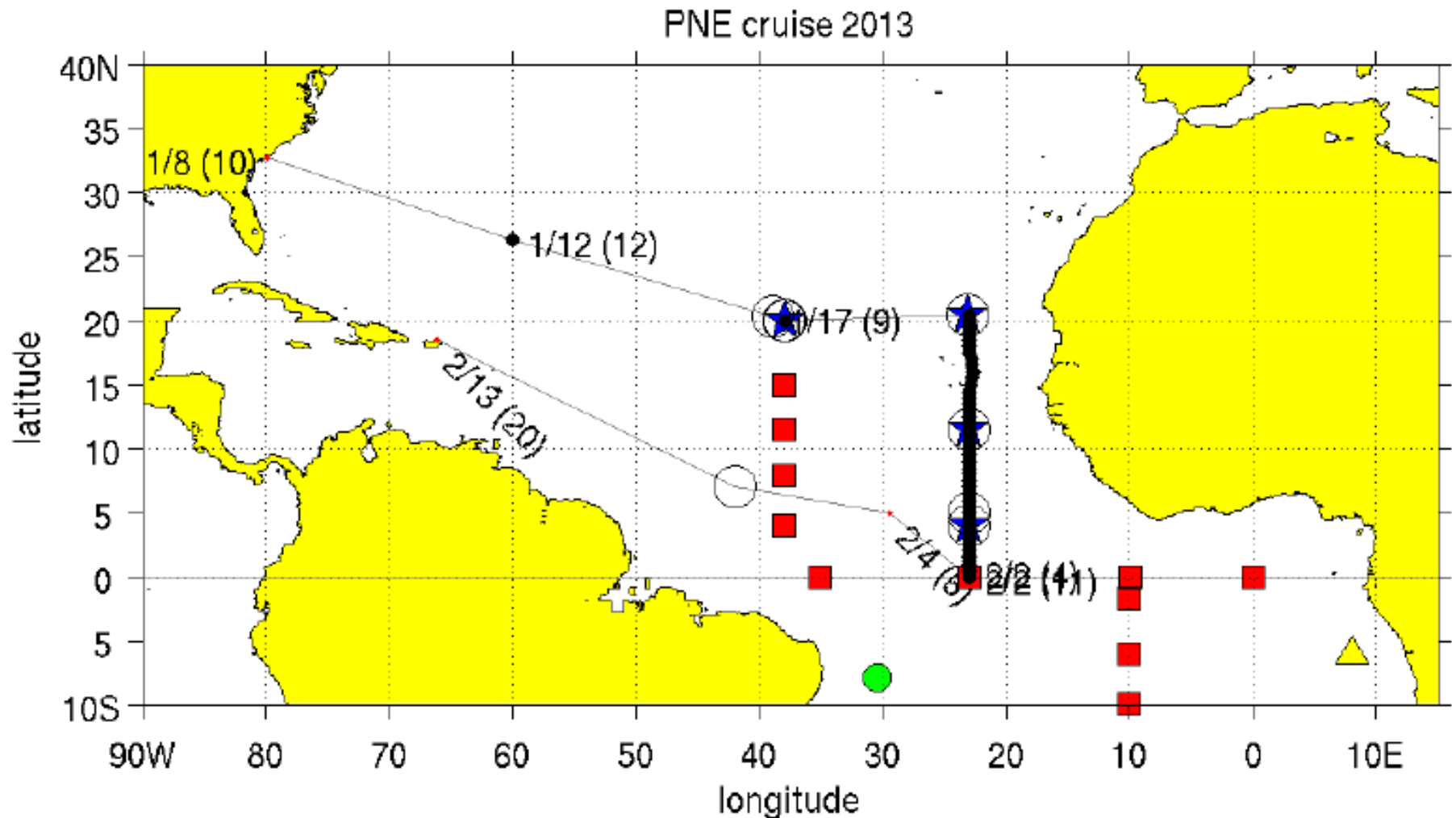
Issues:

- 4°N 23°W: last transmission 27 May 2012.**
- 20°N 38°W (supporting SPURS): missing SSC, T/C at 20m, 40m and 80m, SWR, LWR.**
- 20°N 23°W, 11.5°N 23°W: subset of sensors failed.**

Status of Presently Deployed PIRATA Moorings

Updated Jan 15, 2013





Ship track for 2013 PNE cruise, 8 January—13 February,
Charleston SC to San Juan, PR.



All PNE moorings to be serviced, as well as T-FLEX mooring at
20°N, 38°W. CTD casts, underway CTD, TSG, ADCP, XBT, etc.

PNE Data

PIRATA mooring data available at http://www.pmel.noaa.gov/tao/data_deliv/deliv.html.

Quality-controlled CTD, XBT cruise data available from PNE web site

<http://www.aoml.noaa.gov/phod/pne/index.php>



PIRATA Northeast Extension

Tropical Atlantic Observations for Climate and Weather

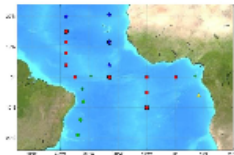
[NOAA](#) [AOML](#) [PhOD](#) **[PNE](#)**

[PhOD Homepage](#)
[Global Ocean Observations](#)
[PIRATA Northeast Extension](#)
[About PIRATA](#)
[Tropical North Atlantic](#)
[PNE Cruises](#)
[Data and Products](#)
[PIRATA Publications](#)
[Related Projects](#)

Introduction

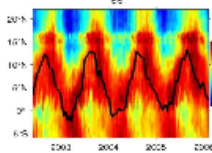
The PIRATA Northeast Extension (PNE) project is a joint [AOML](#) and [PMEL](#) effort to expand the PIRATA array of tropical Atlantic ATLAS moorings into the northern and northeastern sectors of the Tropical Atlantic Ocean. Links below provide more information on PIRATA, the climate significance of the Tropical North Atlantic, PNE cruises, and related projects such as AMMA, TACE and AEROSE.

About PIRATA



The PIRATA project is a joint effort between Brazil, France and the United States to collect oceanic and meteorological observations in the tropical Atlantic. PNE is the Northeast Extension of this project. [More...](#)

The Tropical North Atlantic



The Tropical North Atlantic (TNA) region is of particular climate significance for rainfall patterns in the United States, central and South America, and Africa. It is also the region where Cape Verde-style hurricanes develop from African easterly waves ... and where many waves do not intensify into tropical cyclones. [More...](#)

PNE Cruises

Each year, an oceanographic cruise is used to service the PIRATA Northeast Extension

